

# SYSTEM AND METHOD FOR PROVIDING ACCESS TO DISPLAYED DATA

## Field of the Invention

The present invention relates to a method for providing access to displayed data, and a system implementing the method.

## 5 Background of the Invention

An exemplary prior art hardware/software display arrangement in a computer system is shown in Fig. 1. A display memory 102 is connected to display circuitry 104, which generates a display signal based on the contents of display memory 102. Display memory 102 contains data representing display windows controlled by various application programs, such as owning application window 106 and other application windows 108.

Also present in the computer system is main memory 110, which contains a variety of programs and routines that are executed by the computer system. Main memory contains owning application 112, other applications 114, display management application program interfaces (API's) 116, device drivers 118 and, in this example, requesting application 120. Although the term application is used in this document to refer to application 112 and other applications 114, one of skill in the art would recognize that the description herein is equally applicable to any executing process in a computer system.

Owning application 112 owns owning application window 106, while the other applications 114 own the other application windows 108. Owning application 112 may display data of any kind, such as text, images, video, etc., in owning application window 106, as well as other objects, such as control buttons, text entry boxes, sliders, etc. For example, owning application 112 may display data such as displayable data 115. In order to display data or other objects, owning application 112 communicates with display memory 102 through API's 116, which provide a device-independent interface to the device-specific device drivers 118, which access and control the hardware of display memory 102 and display circuitry 104.

Another application, such as requesting application 120 may request access to the data displayed in application window 106. A problem arises when the requested data is unobtainable, such as may occur when the data is protected from access, when the data is in a format that is not compatible with the data request, or when the data simply does not exist, as may occur if a window is not actually visible. Currently, an error is generated and no data is returned.

A need arises for a technique that will determine what data should be supplied to an application when the application attempts to access data that is either not present, or not authorized to be accessed.

## Summary of the Invention

The present invention is a system and method for providing access to displayed data by determining what data should be supplied to an application when the application attempts to access data that is either not present, or not  
5 authorized to be accessed. In order to carry out the method of the present invention, a request for data of a first process is received from a second process. At the first process, a resolution to the request for data received from the second process is generated and the generated resolution is transmitted from the first process to the second process.

10 In one embodiment of the present invention the requested data is protected data and the received resolution comprises a modified version of the protected data. The modified version of the data may comprise data substituted for at least a portion of the protected data or data augmenting the protected data. The data substituted for at least a portion of the protected data may comprise a pattern or a  
15 message indicating where the protected data would have been displayed. The data augmenting the protected data may comprise a copyright notice.

In another embodiment of the present invention, the requested data is data that is not being displayed and the received resolution comprises the requested data.

20 In another embodiment of the present invention, the requested data does not exist and the received resolution comprises a generated version of the requested data.

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In another embodiment of the present invention, the requesting step comprises the step of transmitting information relating to the request for data to the first process and wherein the received resolution is based on the information relating to the request for data. The information relating to the request for data  
5 may identify a process requesting the data and the received resolution may be based on the identified process or the information relating to the request for data may indicate a use to be made of the data and the received resolution may be based on the indicated use.

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In another embodiment of the present invention, the requested data  
10 comprises image data. The received resolution may comprise image data having a different color depth than the requested data. The received resolution may comprise image data having a different pixel resolution than the requested data. The received resolution may comprise image data that is not the requested data.

In another embodiment of the present invention, the requested data may  
15 comprise an image of text displayed in a first font and the received resolution may comprise an image of the text displayed in a second font.

In another embodiment of the present invention, the step of generating the resolution comprises the steps of: transmitting a request for additional information relating to the request for data from the first process to the second process,  
20 receiving a response to the request for additional information from the second process, and generating, at the first process, a resolution to the request for data received from the second process based on the response to the request for

additional information received from the second process. The received response to the request for additional information may comprise information identifying a process requesting the data. The received response to the request for additional information may comprise information indicating a use to be made of the data.

- 5 The received response to the request for additional information may comprise information relating to attributes of the data.

### **Brief Description of the Drawings**

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10 The details of the present invention, both as to its structure and operation, can best be understood by referring to the accompanying drawings, in which like reference numbers and designations refer to like elements.

Fig. 1 is an exemplary block diagram of a prior art display system.

Fig. 2a is an exemplary block diagram of an embodiment of a display system, according to the present invention.

15 Fig. 2b is a flow diagram of a process which may be implemented in the system of Fig. 2b.

Fig. 3 is an exemplary screen display generated by one embodiment of the present invention.

20 Fig. 4 is an exemplary screen display generated by one embodiment of the present invention.

Fig. 5 is an exemplary screen display generated by one embodiment of the present invention.

Fig. 6 is an exemplary screen display generated by one embodiment of the present invention.

Fig. 7 is an exemplary screen display generated by one embodiment of the present invention.

5 Fig. 8 is an exemplary screen display generated by one embodiment of the present invention.

Fig. 9 is an exemplary screen display generated by one embodiment of the present invention.

10 Fig. 10 is an exemplary screen display generated by one embodiment of the present invention.

Fig. 11 is an exemplary screen display generated by one embodiment of the present invention.

Fig. 12 is an exemplary screen display generated by one embodiment of the present invention.

15 Fig. 13 is an exemplary screen display generated by one embodiment of the present invention.

Fig. 14 is a data flow diagram of a process of a further embodiment of the present invention.

20 Fig. 15 is a data flow diagram of an example of processing shown in Fig. 14.

## Detailed Description of the Invention

An exemplary hardware/software display arrangement in a computer system is shown in Fig. 2a, in which may be implemented the process shown in Fig. 2b. A display memory 202 is connected to display circuitry 204, which generates a display  
5 signal based on the contents of display memory 202. Display memory 202 contains data representing display windows owned by various application programs, such as owning application window 206 and other application windows 208.

Also present in the computer system is main memory 210, which contains a variety of programs and routines that are executed by the computer system. Main  
10 memory contains owning application 212, other applications 214, display management application program interfaces (API's) 216, device drivers 218 and, in this example, requesting application 220. Although the term application is used in this document to refer to owning application 212, other applications 214, and requesting application 220, one of skill in the art would recognize that the description  
15 herein is equally applicable to any executing process in a computer system.

Owning application 212 controls owning application window 206, while the other applications 214 control the other application windows 208. As shown in step 250 of Fig. 2b, owning application 212 displays displayable data 222 in owning application window 206, within display memory 202. In order to create  
20 displayable data 222, owning application 212 communicates with display memory 202 through API's 216, which provide a device-independent interface to the

device-specific device drivers 218, which access and control the hardware of display memory 202 and display circuitry 204.

In step 252 of Fig. 2b, requesting application 220 requests access to displayable data 222. An application may attempt to access displayed data of another application in several ways. For example, requesting application 220 can access owning application window 206 through the display management API's 216 using handle 224, or by directly accessing the physical display memory 202. When an application attempts to access displayed data of another application, such attempted access is detected, and, in step 254 of Fig. 2b, callback module 226 is invoked. In the embodiment of the present invention shown in Fig. 2a, display management API's 216 use process information 228 to detect the attempted access. Process information 228 is information that associates each region of display memory 202 with a process that owns that region at the present time. Other mechanisms may be used to detect the attempted access. Depending upon the detection mechanism, the callback module may be invoked by calling a registered function (in the case where an API detects the attempted access), by an interrupt, page fault, or other hardware generated condition, etc.

In any case, in step 254 of Fig. 2b, the callback module 226 calls owning application 212 to request a resolution to the attempted access. Callback module 226 may pass information about the attempted access, such as the identity of requesting application 220, a desired format, etc., to owning application 212. In step 256 of Fig. 2, owning application 212 invokes response module 230, which,



in step 258, determines what action to take and generates a resolution, examining the information about the attempted access if necessary.

The action determined and resolution generated by response module 230 may depend upon several factors, such as the type of data involved in the attempted access, the application attempting to access the data, etc. For example, if the data involved in the attempted access is protected, and the application attempting to access the data is not authorized to do so, then typically, response module 230 will generate a modified version of the protected data, which will be supplied to requesting application 220. For example, response module 230 may generate a pattern or a message, such as pattern 302, shown in Fig. 3, that would indicate where the protected data would have been displayed. Response module 230 may augment the protected data by, for example, adding a copyright notice 402, as shown in Fig. 4, or by blurring or obscuring some or all of the protected data, as shown in Fig. 5. In addition, several modifications may be applied simultaneously.

Other situations may arise. The data involved in the attempted access may not be present in display memory 202. For example, the data may be off screen, or it may not have been generated yet. In this case, response module 230 may return the actual data, generating it if necessary. Response module 230 may generate different versions of the requested data depending upon the application that is requesting it. For example, the displayed data may be a color image, such as image 602, shown in Fig. 6. A requesting application may request a black and

white image, in which case the response module would generate a black and white version of the requested image, such as image 702, shown in Fig. 7, and return the black and white image to the requesting application. Likewise, the requesting application may request a color version of a black and white image, in which case the owning application may provide the color version, if it is available, provide the black and white version in the requested color format, or may indicate that a color version of the image cannot be provided.

Another example is shown in Figs. 8 and 9. The displayed image 802, shown in Fig. 8, is a high pixel resolution image. The owning application may provide a lower pixel resolution image 902, shown in Fig. 9, to the requesting application, either in response to a request for a particular resolution or a lower pixel resolution image, or because the owning application does not wish to provide the higher pixel resolution image to the requesting application. This may be useful, for example, where higher pixel resolution images are used for display purposes, but only lower pixel resolution images are provided without payment of a fee. The present invention may also be used to provide images having higher resolution than the displayed image, or to provide images of various resolutions. For example, the information sent with the request for the image could include payment information and the response module could determine what resolution image to provide.

Another example is shown in Figs. 8 and 9. The displayed image 1002 is shown in Fig. 10. The owning application may provide a modified or even a different image 1102 to the requesting application.

Another example is shown in Figs. 12 and 13. The displayed data 1202, shown in Fig. 12, includes text displayed in a font that is suitable for screen display, but which may not be suitable for other uses. The requested data in this example is not the text data, but is the data representing an image of the text. For example, if the requesting application will print the data including text, a higher resolution or anti-aliased version of the text may be desirable. Likewise, if the text is to be processed by optical character recognition (OCR) software, it may be desirable to provide a version that includes the text in a more OCR compatible font, as in image 1302, shown in Fig. 13.

In a further embodiment of the present invention, the owning application and the requesting application may have further communications regarding the data to be provided, as shown in Fig. 14. The process shown in Fig. 14 may be considered an enhancement to step 258 of Fig. 2b. In step 1402, after the response module has been invoked in step 256 of Fig. 2b, the response module sends an extended request to the requesting application. The extended request is for information which must be provided to the response module in order for the response module to generate the proper resolution, or which is advantageous to be provided to the response module in order for the response module to generate an improved resolution. For example, the response module may request information

regarding "why" the requesting application wants the data, in the sense of the use the requesting application will make of the requested data. Likewise, the response module may request information about the identity of the requesting application or about format or attributes of the data desired by the requesting application.

5 In step 1404, the requesting application provides the information requested by the response module in step 1402. In step 1406, the response module analyzes the information received from the requesting application to determine if any additional information is necessary. If additional information is necessary, the response module may repeat steps 1402-1406, in order to obtain the additional  
10 information from the requesting application. Once the response module has all the necessary information, or is unable to obtain any additional information, then, in step 1408, the response module determines what action to take and generates a resolution using the received information. If the response module is unable to obtain necessary information, an error may be generated, or alternatively, a default  
15 resolution or a resolution based on at least some default information may be generated.

An example of the data flow that occurs in the processes shown in Figs. 2b and 14 is shown in Fig. 15. Requesting application 1502 requests access to data 1504. The data request 1506 may include additional information, such as, in this  
20 example, an indication 1508 of the resolution desired by requesting application 1502. As shown in Fig. 2b, the data request is routed to response module 1510.

Response module 1510 may examine data 1504 and attributes 1512, in order to

determine an action to take in response to data request 1506. In this example, data 1504 is an image and attributes 1512 are therefore image attributes. Attributes 1512 include attributes such as the current resolution 1514, the current color depth 1516, and the current magnification 1518 at which the image is being displayed, as well as available resolutions 1520, available color depths 1522, and available magnifications 1524, at which the image data may be provided.

In the example of Fig. 15, response module 1510 determines that three attributes, resolution, color depth, and magnification, may be specified for the image data to be provided and that only one attribute, resolution, has been specified by requesting application 1502. Response module 1510 then sends an extended request 1526 for additional information regarding the unspecified attributes to requesting application 1502. In this example, extended request 1526 includes a request for a color depth specification 1528 and a request for a magnification specification 1530. Requests 1528 and 1530 may include information relating to the current settings 1516 and 1518 of these attributes and/or information relating to available settings 1522 and 1524 of these attributes.

The requesting application receives extended request 1526 and may ignore the extended request or respond to it. In the example of Fig. 15, requesting application 1502 responds to extended request 1526 by sending extended response 1532 to response module 1510. Extended response 1532 only includes a specification of color depth 1534 and not a specification of magnification.

Response module 1510 may respond to this in several ways. Response module

1510 may return an error. Response module 1510 may repeat steps 1402-1406 of Fig. 14 and send one or more additional extended requests to requesting application 1502 in an attempt to obtain the unspecified information. Or, response module 1510 may use a default value, such as the current magnification 1518.

- 5 Once response module 1510 has all necessary information, it generates resolution 1536, which is the image data requested by requesting application 1502, modified as specified.

Although specific embodiments of the present invention have been described, it will be understood by those of skill in the art that there are other embodiments that  
10 are equivalent to the described embodiments. Accordingly, it is to be understood that the invention is not to be limited by the specific illustrated embodiments, but only by the scope of the appended claims.